

# *Advanced Aladin & Topcat*

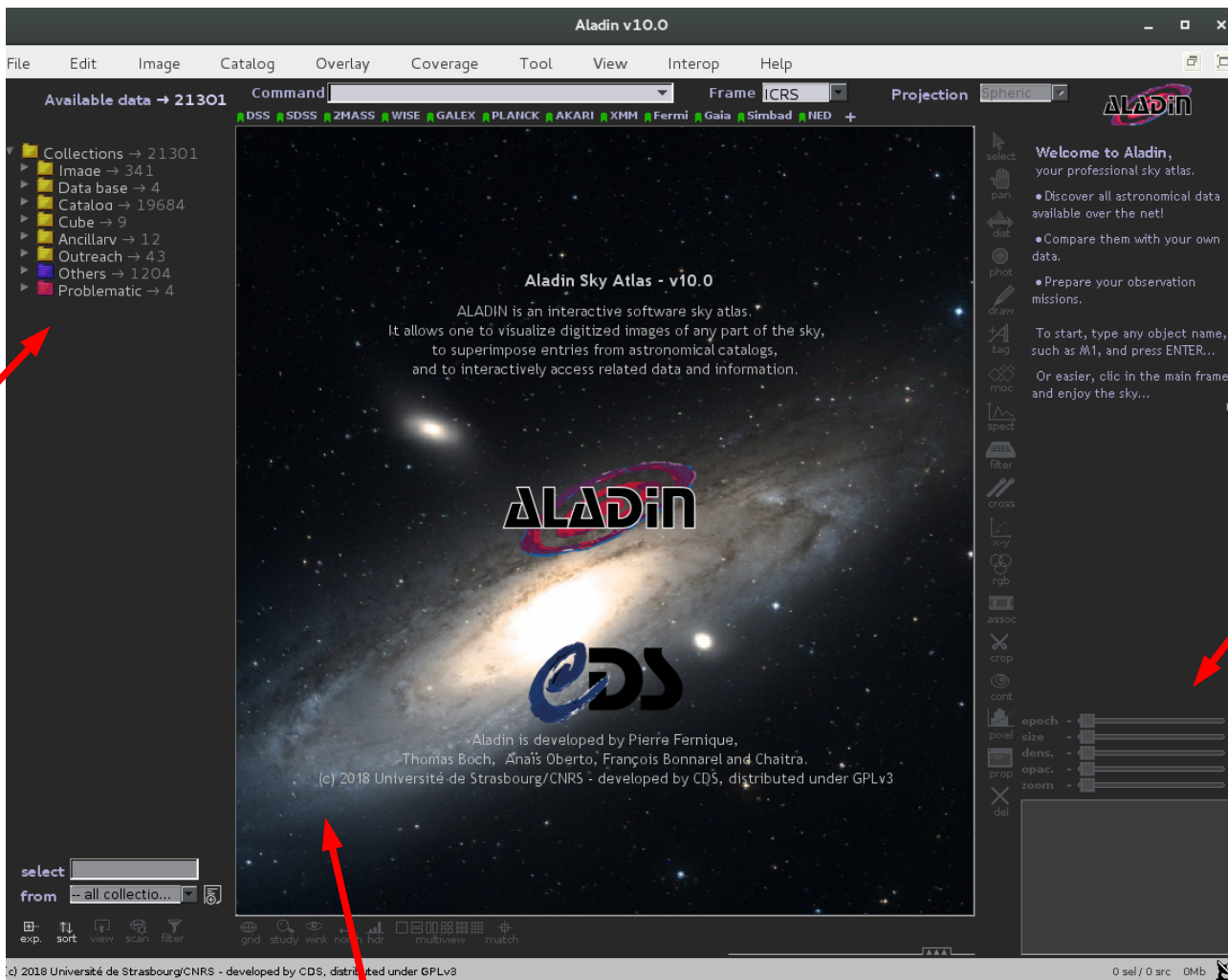
Miriam Cortés



EXCELENCIA  
MARÍA  
DE MAEZTU



# Aladin: main window

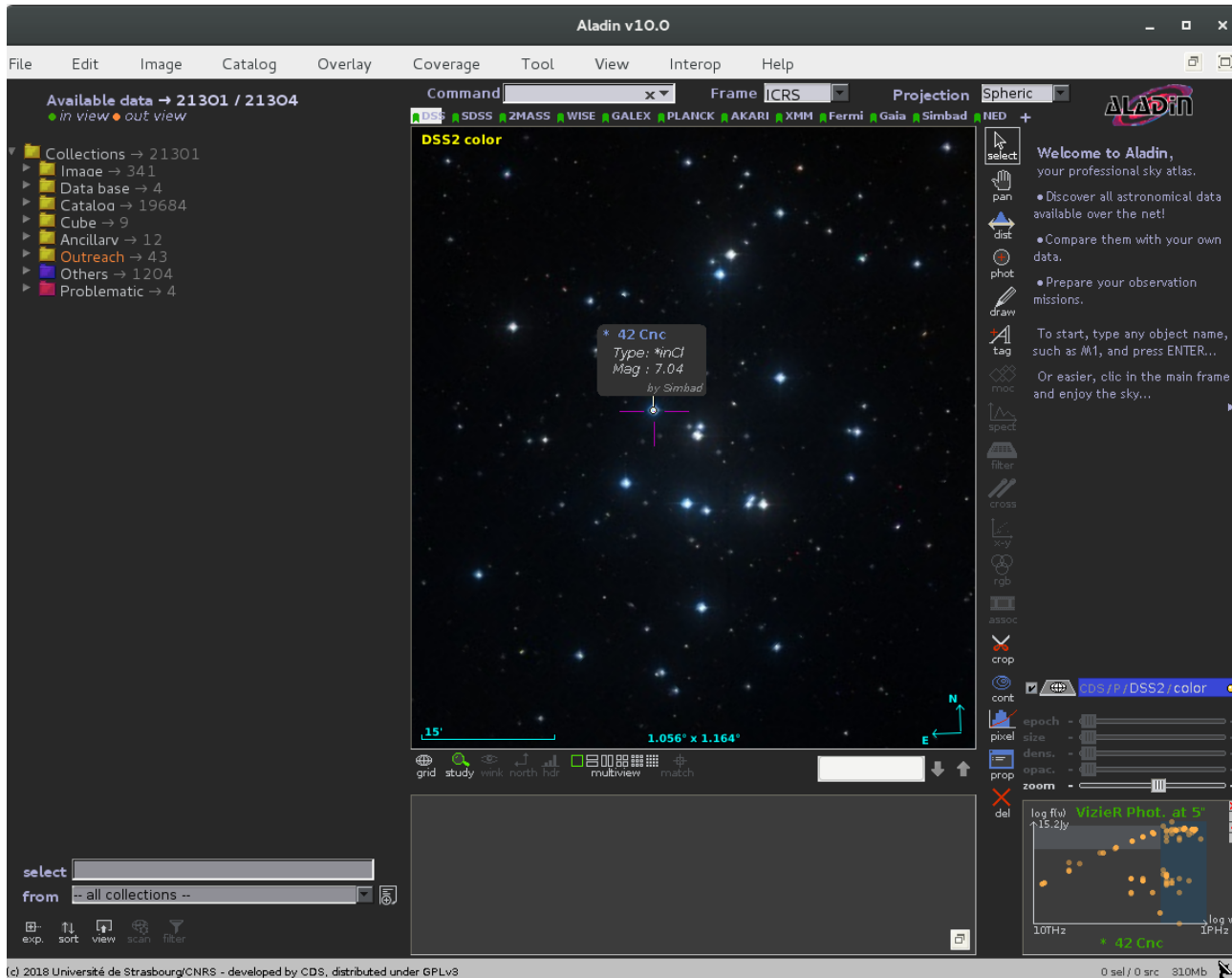


Tree panel  
for data  
collections

Panel for  
loaded  
tables,  
images and  
catalogues

Visualization panel

# Aladin: Simbad & Vizier info



- \* By clicking the right button → Astronomical object exploration (Simbad & Vizier)
- \* Hitting the blue text will open a new page in your browser pointing to Simbad

# Aladin: CDS X-match

\* Overlay/phot: draw a circular region

\* Load catalogue from the left hand panel “by region & MOC” → this will load all sources in the catalogue within the region drawn

\* Load another catalogue from the left hand panel “by CDS Xmatch”) → this will cross-match both catalogues in the region drawn and load the result

Aladin v10.0

File Edit Image Catalog Overlay Coverage Tool View Interop Help

Available data → 21301 / 21304  
in view out view

Command 13.75 +19:44:55.8 x Frame ICRS Projection Spheric

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad IED +

2MASS-PSC - 2MASS All-Sky Catalog of Point Sources ...  
Provenance: CDS  
Coverage: 89.52% Reference pub. year: 2003 Nb rows: 470,992,970

Access mode  progressive  in view  by region & MOC  by CDS Xmatch  by criteria  
derived prod.  coverage  density map

Load

CDS/J246/out

angD1.st	RAJ2000	DEJ2000	V	RAJ2000	DEJ2000	objID
1.253834	130.061004	19.738149	V1z1eR	130.0610...	19.73814...	
0.072318	130.063512	19.752887	V1z1eR	130.0635...	19.75288...	
0.160703	130.060716	19.737896	V1z1eR	130.0607...	19.73789...	
0.101908	130.066778	19.740068	V1z1eR	130.0667...	19.74006...	
0.552054	130.057288	19.748841	V1z1eR	130.0572...	19.74884...	
0.521157	130.078621	19.754306	V1z1eR	130.0786...	19.75430...	
0.583303	130.164083	19.715372	V1z1eR	130.1640...	19.71537...	
1.595681	130.164018	19.714995	V1z1eR	130.1640...	19.71499...	

select from --all collections--

col. sort view zoom filter

Adjust the visible Search

epoch size dens. opac. prop zoom del

08 40 22.53 +19:40:49.5  
10.68" x 11.77"

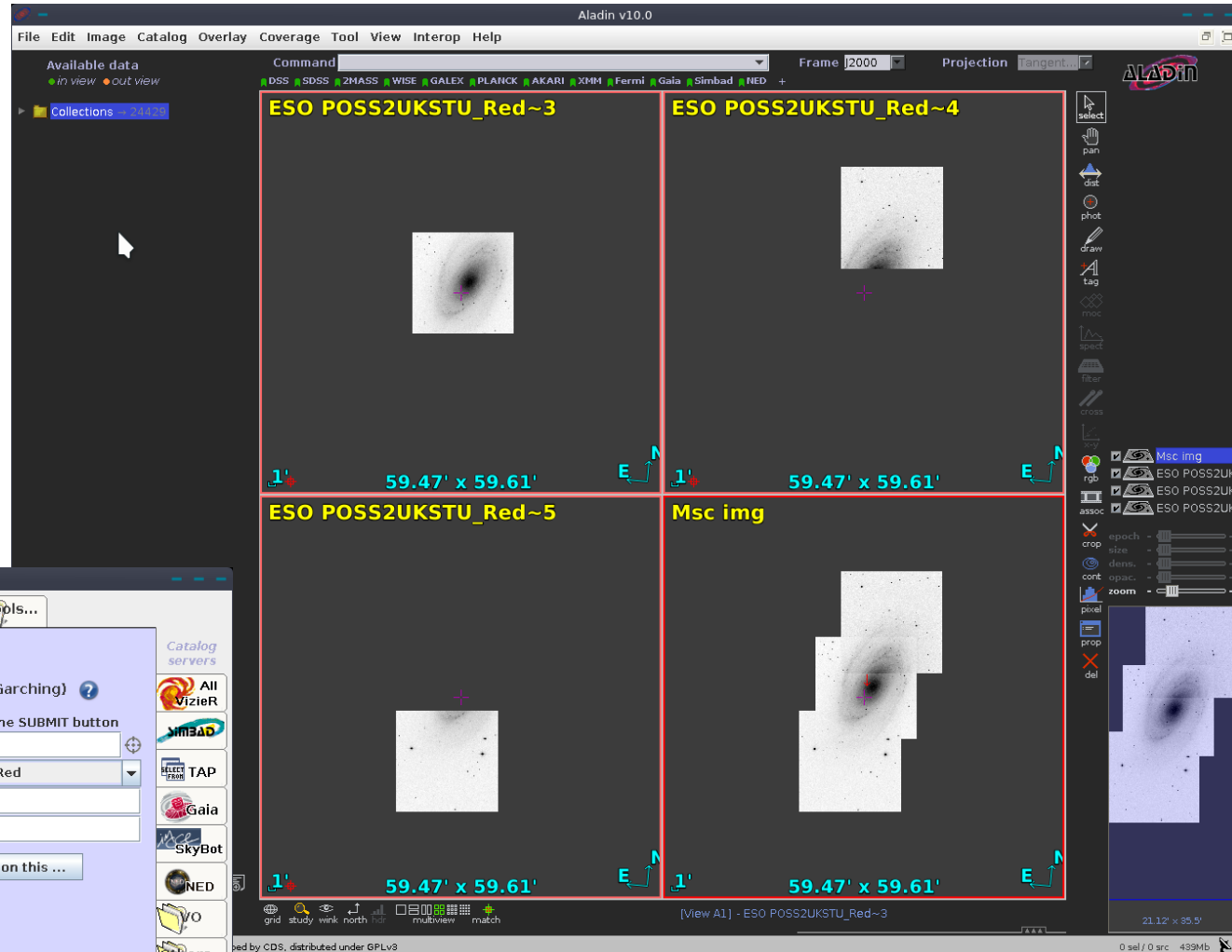
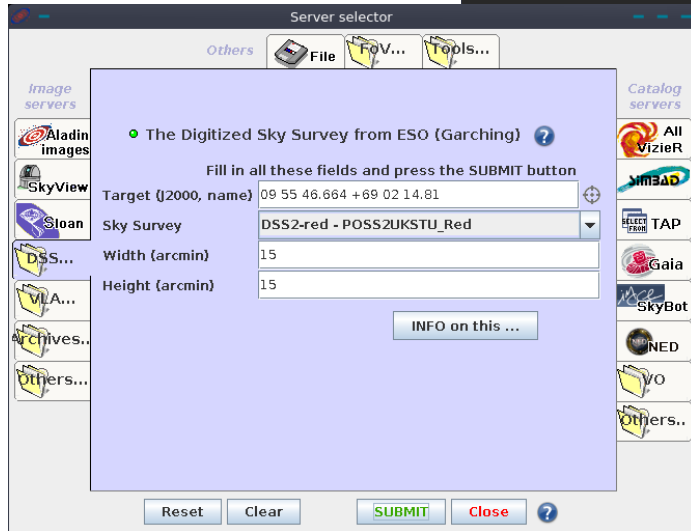
125 sel / 876 src 1078Mb

(c) 2018 Université de Strasbourg/CNRS - developed by CDS, distributed under GPLv3

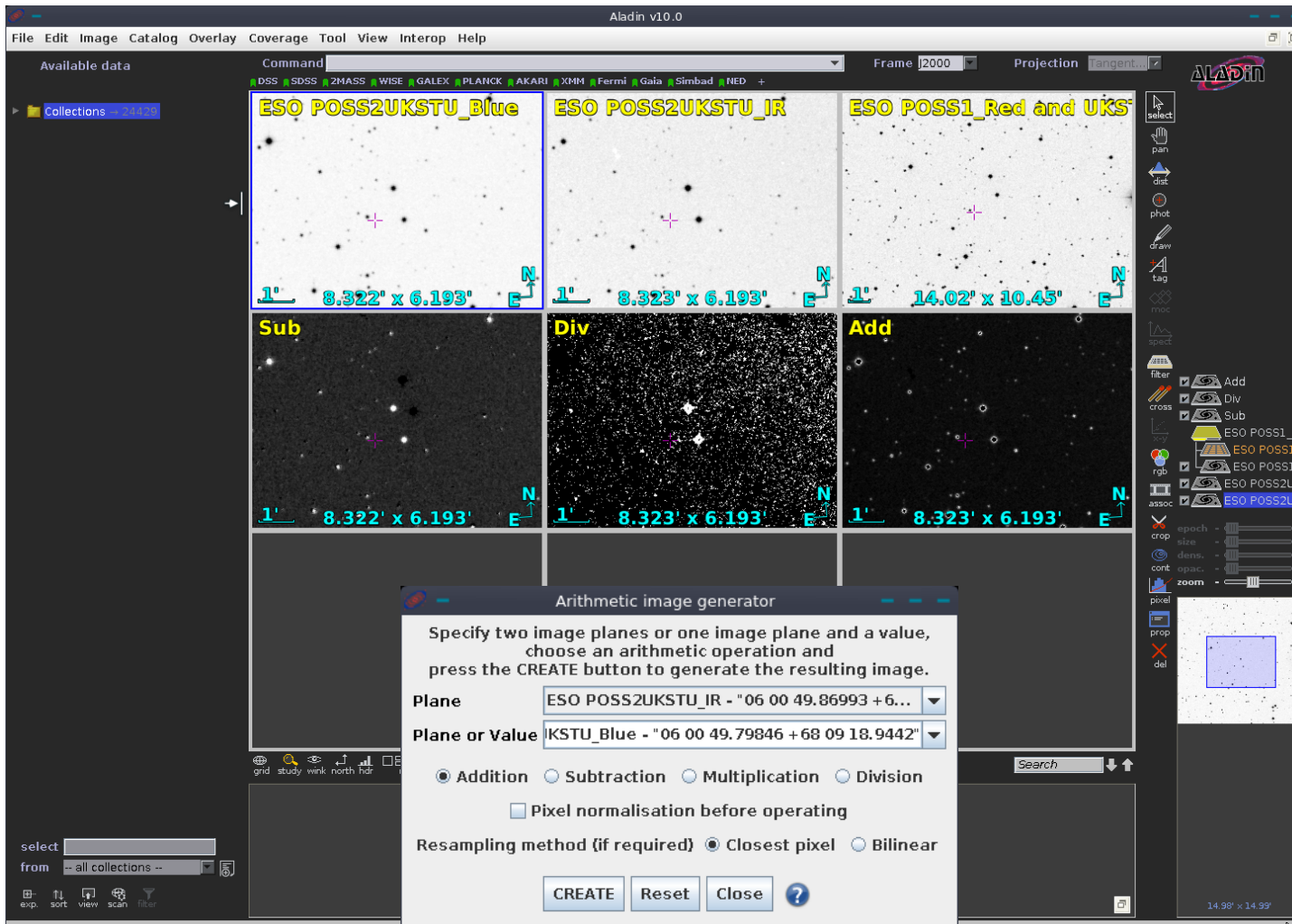
# Aladin: Mosaic builder

\* File/Open Server selector: load images in a specified region

\* Image/Mosaic image builder: create a mosaic with the loaded images



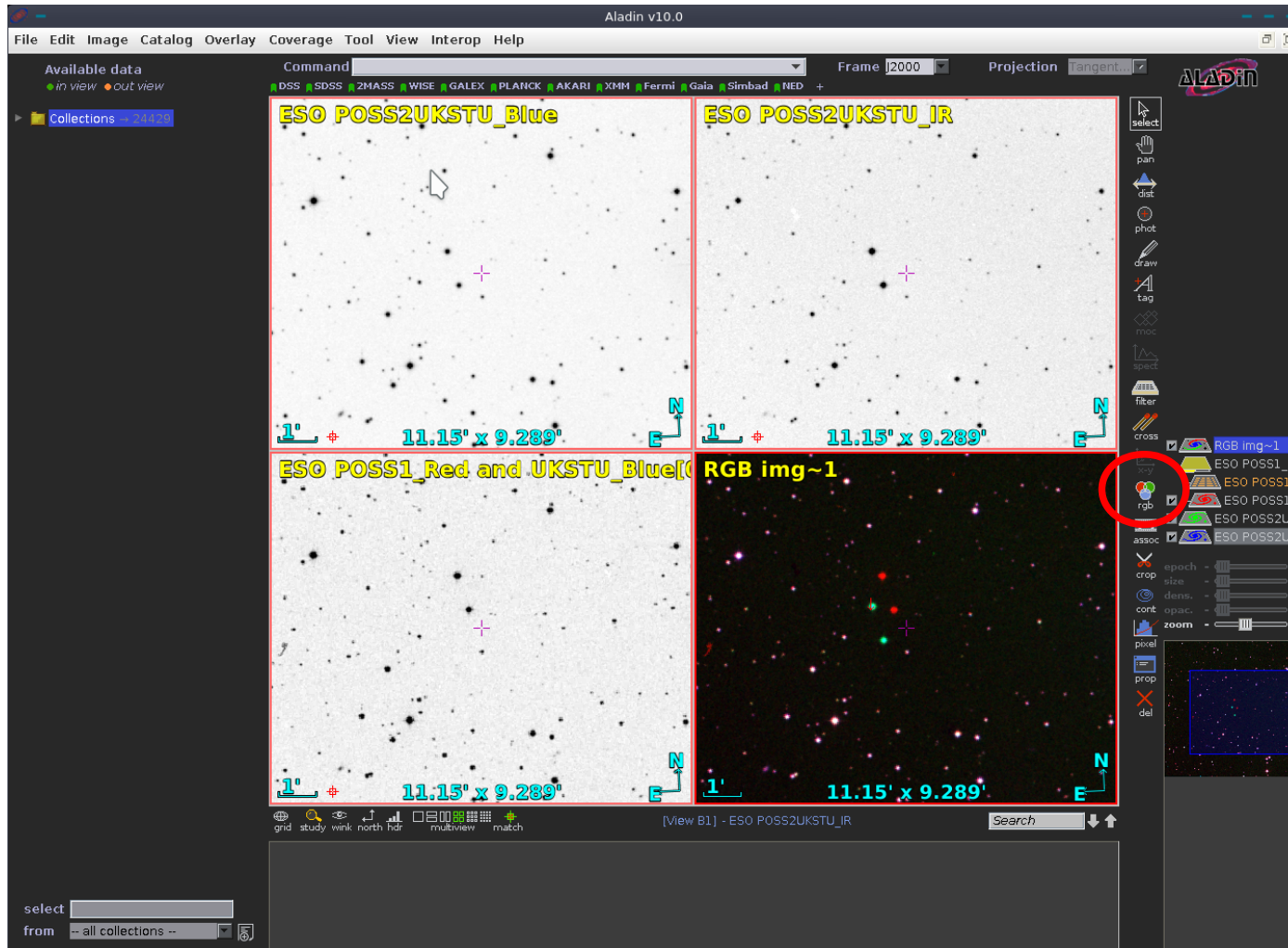
# Aladin: Arithmetic operation



\* File/Open Server selector: load images in a specified region

\* Image/Arithmetic operation: operate between loaded images to create a new image

# Aladin: RGB builder



\* File/Open Server selector: load images in a specified region

\* Image/RGB image builder: create a RGB composite image

# Aladin: Blink/movie

\* Image/Blink-movie generator: creates a blinking image or movie with loaded images

The screenshot displays the Aladin v10.0 software interface. The main window shows an astronomical image titled "ESO POSS1\_Red and UKSTU\_Blue[0]". The image is a grayscale field of stars with a red crosshair marking a specific star. The interface includes a menu bar (File, Edit, Image, Catalog, Overlay, Coverage, Tool, View, Interop, Help), a toolbar with various tools (select, pan, dist, phot, draw, tag, mac, aspect, filter, cross, zoom), and a status bar at the bottom showing coordinates (19.77' x 18.75') and a search bar.

An "Image associations" dialog box is open in the foreground. It contains the following text:

Specify the images concerned by the association.  
Check Mosaic or Blink association, and press the CREATE button

1)	ESO POSS2UKSTU_Red - "06 00 02.90850 +68
2)	ESO POSS1_Red and UKSTU_Blue[0] - "06 00 0
3)	-- none --
4)	-- none --
5)	-- none --
6)	-- none --

Below the list, there are radio buttons for "Mosaic" and "Blink seq." (selected), with a "- delay:" field set to "400 ms". There is also a "Sampling reference image:" field set to "1". At the bottom of the dialog are buttons for "CREATE", "Reset", "Close", and a help icon.

The "Image associations" dialog box is positioned over the main image, and the "Blink seq." radio button is highlighted with a red circle in the original image.



# Aladin: Load instrument FoV

\* File/Load instrument FoV: load the Field of View of an instrument in the specified region

The screenshot displays the Aladin v10.0 software interface. The main window shows a star field with a grid of four instrument fields of view (FoV) overlaid, labeled 54, 60, 53, and 77. The central FoV is labeled 'SDSS9 color'. The interface includes a menu bar (File, Edit, Image, Catalog, Overlay, Coverage, Tool, View, Interop, Help), a command bar, and a toolbar on the right. A 'Server selector' dialog box is open in the foreground, showing a table of instrument fields of view.

**Server selector dialog box:**

Instrument fields of view

Specify a position, select one instrument and press the SU...

Target (J2000, name) 08 23 09.277 +53 06 25.15

Angle (in degrees) 1

Instrument	Teles...	Description	Author
HSC	Subaru	Hyper-SuprimeCam	Herve B...
VIRcam	VISTA	Wide Field IR camera	Laurent ...
FORS1	VLT	ESO FOCal Reducer/low dispersion S...	ESO-CDS
FORS2	VLT	ESO FOCal Reducer/low dispersion S...	ESO-CDS
ISAAC	VLT	ESO infrared imager and spectrograph	ESO-CDS
VIMOS	VLT	ESO VIMOS mosaic camera	ESO
DECam	Victor M...	Dark Energy Camera with imaging (bl...	Luis Cic...
WFI	WFI2.2m	ESO Wide Field Imager	ESO
PPFP	WHT	William Herschell Telescope mosaic ...	Luis Corral
EPICMOS	XMM	Sensitive imaging (0.1 to 15 keV)	CDS
EPICpn	XMM	High resolution (<0.03ms)	CDS

Buttons: Create your o..., Load it..., Reset, Clear, SUBMIT, Close

# Aladin: Tools / Remote tools/Tools / Sextractor

\* Tool/Remote Tools/Tools/S-extractor: extract sources (position and photometry) in an image

The screenshot shows the Aladin v10.0 interface. The main window displays an astronomical image titled "ESO POSS2UKSTU\_Red". A "Server selector" dialog box is open, showing the configuration for the "S-extractor facility (v2.8.6)". The dialog box includes fields for "Image reference", "Threshold (x RMS)", "Mag zero point", "Saturation (ADU)", "stellar FWHM (arcs...)", "Filter type", "Phot diam. apertur...", "Background type", "Backgd annulus thi...", and "Display filter". The "Display filter" is set to "Object elongation".

At the bottom of the main window, a table of extracted sources is visible:

NUMBER	MAG ISO	MAGERR ISO	MAG ISOCOR	MAGERR ISOCOR	MAG APER	MAGERR APER	MAG AUTO
256	-10.4743	0.0783	-10.8695	0.1226	-10.6085	0.0850	-10.7665
261	-15.1061	0.0045	-15.1441	0.0054	-13.7073	0.0049	-15.1287
273	-11.4848	0.0392	-11.6579	0.0577	-11.4336	0.0398	-11.5101

# Aladin: HIPS

- Hierarchical Progressive Survey
- Visualize a survey “*a la Google maps*”.
- Multi-scale view of images with capability to zoom and pan on any region.

Astronomy & Astrophysics manuscript no. Fernique\_Allen\_04May2015  
May 12, 2015

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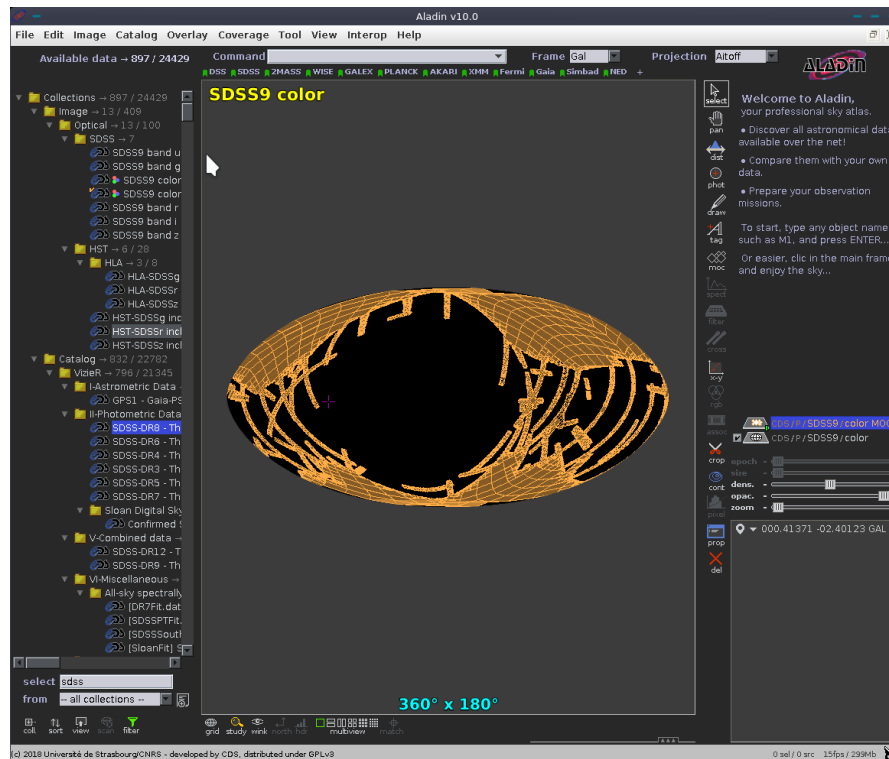
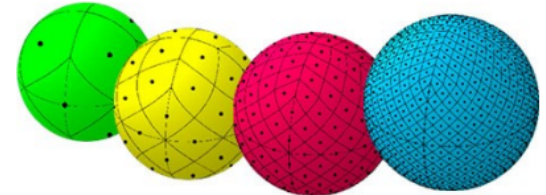
## **Hierarchical progressive surveys**

**Multi-resolution HEALPix data structures for astronomical images, catalogues,  
and 3-dimensional data cubes**

P. Fernique<sup>1</sup>, M. G. Allen<sup>1</sup>, T. Boch<sup>1</sup>, A. Oberto<sup>1</sup>, F-X. Pineau<sup>1</sup>, D. Durand<sup>2</sup>, C. Bot<sup>1</sup>, L. Cambrésy<sup>1</sup>, S. Derriere<sup>1</sup>, F. Genova<sup>1</sup>, and F. Bonnarel<sup>1</sup>

# Aladin: MOC

- **Multi-object coverage (MOC):** Method for describing sky regions
- Based on **Healpix** (list of HEALPIX cells stored in a FITS binary table)
  - Equal-area cells & isolatitude → Speed.



# Aladin: MOC

\* Coverage/Load the coverage (MOC) of the current survey

The screenshot displays the Aladin v10.0 interface. The 'Coverage' menu is highlighted in the top bar. The main window shows a 3D visualization of the Multi-Order Coverage Map (MOC) for the SDSS9 color survey, rendered as a yellow wireframe on a black background. A 'Properties' dialog box is open, showing the configuration for the 'CDS/P/SDSS9/color MOC' plane. The 'Format' is set to 'Multi-Order Coverage map (MOC)', and the 'Coverage' is 36.194% of the sky, corresponding to 14931 cells. The 'Best MOC ang.res.' is 3.433 (mocs order = 10). The 'Drawing method' includes 'cell borders' and 'fill in'. The 'Coord.sys.' is set to 'ICRS'. A 'Load' dialog box is also visible, showing the 'SDSS-DR8 - The SDSS Photometric Catalog, Release 8 (Adelma...)' with a 'coverage' checkbox selected. The interface includes a file explorer on the left, a toolbar on the right, and a status bar at the bottom.

Available data → 897 / 24429

SDSS9 color

Properties

Properties of the plane "CDS/P/SDSS9/color MOC"

PlaneID: CDS/P/SDSS9/color MOC

Color: [Color selection palette]

Format: Multi-Order Coverage map (MOC)

Coverage: 36.194% of sky => 14931<sup>cell</sup>

Best MOC ang.res: 3.433 (mocs order = 10)

Drawing method:  perimeter  cell borders  fill in

Coord.sys.: ICRS

Overlay opacity/transparency: [Slider from 0 to 100]

Apply Close

SDSS-DR8 - The SDSS Photometric Catalog, Release 8 (Adelma...)

Provenance: CDS

Coverage: 36.48% Reference pub. year: 2011 Nb rows: 324,960,076

Access mode:  by region & MOC  by CDS Xmatch  by criteria

derived products:  coverage  density map

Load

360° x 180°

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0 sel / 0 src 15fps / 299Mb

# Aladin: MOC

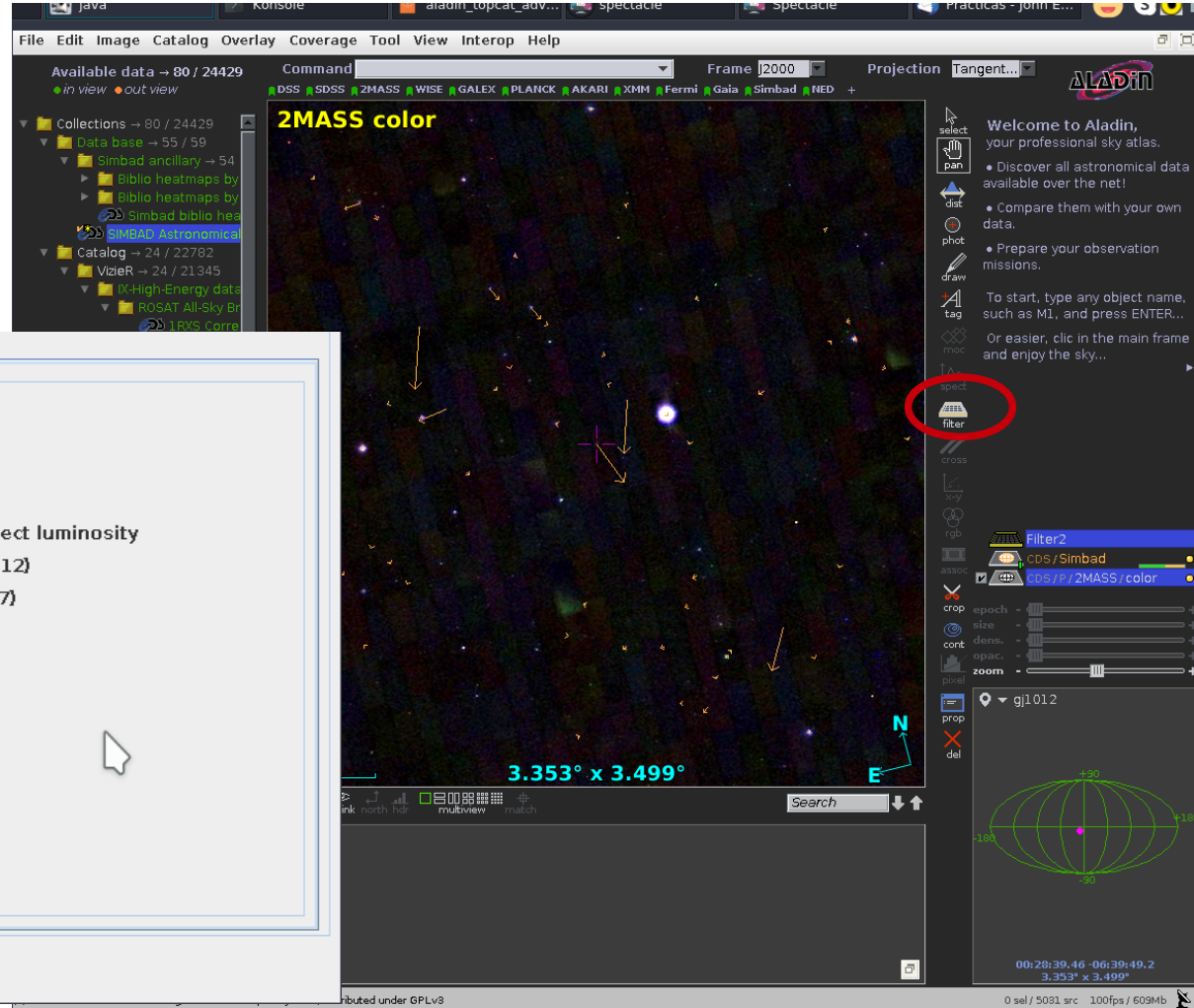
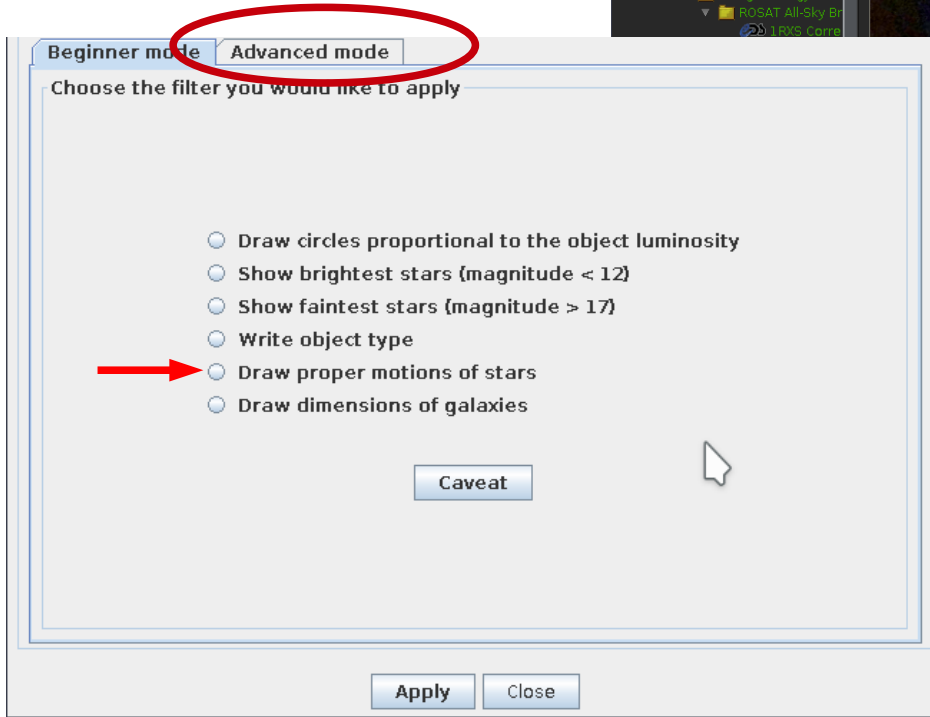
*How to know the area in common between two surveys?*

\* Coverage/Logical operations

The image shows two instances of the Aladin v10.0 software interface. The left window displays a MOC (Mosaic of Observations Coverage) for 'CDS/II/319/las9' in orange and blue. The right window displays the resulting 'Int CDS/P/SDSS9/color MOC' in red and orange. A red arrow points from the left window to the right, indicating the operation. A dialog box titled 'MOC operations' is overlaid in the center, with the following text: 'Specify one or two MOC planes, choose a MOC operation and press the CREATE button to generate the resulting MOC.' The dialog lists two MOC planes: 'CDS/P/SDSS9/color MOC - "17 56 03.71782 -29 48 33.0729"' and 'CDS/II/319/las9 MOC - "17 56 03.71782 -29 48 33.0729"'. Below the list are radio buttons for 'Union', 'Intersection', 'Subtraction', 'Difference', and 'Complement', with 'Intersection' selected. At the bottom of the dialog are 'CREATE', 'Reset', and 'Close' buttons. The background windows show a 360° x 180° MOC visualization and a toolbar with various tools like select, pan, dist, phot, draw, tag, moc, spect, filter, crop, epoch, size, cont, opac, zoom, and prop. The bottom status bar indicates '0 sel / 0 src 58fps / 557Mb'.

# Aladin: filters

\* Catalog/create a filter



# TOPCAT & STILTS

- Both do basically the same things but
  - **TOPCAT**
    - Easier to learn.
    - Good for interactive use, especially exploring data to get a feel for what's there.
  - **STILTS**
    - Better for reproducible work (it can be scripted).
    - Steeper learning curve.



# TOPCAT & STILTS

- Which is the best format?

- [4.1.1.1 FITS](#)
- [4.1.1.2 Column-oriented FITS](#)
- [4.1.1.3 VOTable](#)
- [4.1.1.4 CDF](#)
- [4.1.1.5 ASCII](#)
- [4.1.1.6 IPAC](#)
- [4.1.1.7 Comma-Separated Values](#)
- [4.1.1.8 GBIN](#)
- [4.1.1.9 Tab-Separated Table](#)
- [4.1.1.10 SQL Database Queries](#)
- [4.1.1.11 World Data Center](#)

- Small table (<1000 rows): **doesn't matter.**
- Medium-sized (rows\*cols) < 20million): **FITS.**
- Big (millions of rows, especially with lots of columns): **colfits.**

- If the input file is not in this format you can convert it using STILTS:

- *stilts tpipe in=xxx.csv ifmt=csv out=xxx.fits*

# TOPCAT & STILTS

- Output in Latex

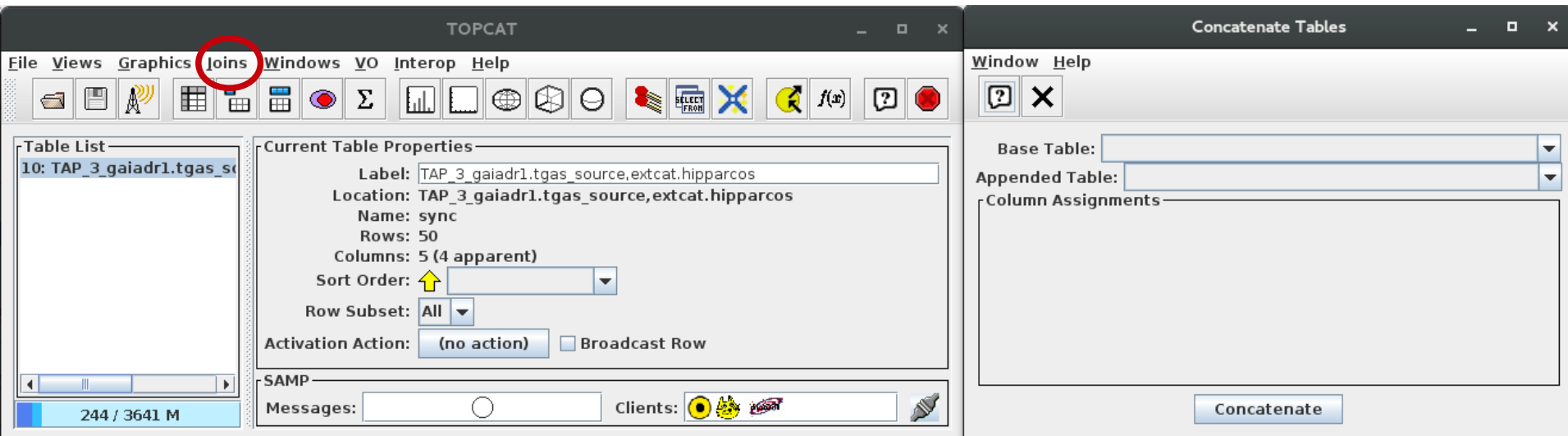
The image shows a screenshot of the TOPCAT software interface. The main window displays the 'Current Table Properties' for a table named 'TAP\_3\_gaiadr1.tgas\_source,extcat.hipparcos'. The properties include: Label: TAP\_3\_gaiadr1.tgas\_source,extcat.hipparcos; Location: TAP\_3\_gaiadr1.tgas\_source,extcat.hipparcos; Name: sync; Rows: 50; Columns: 5; Sort Order: (ascending arrow icon); Row Subset: All.

In the foreground, an Emacs window titled 'tabla\_latex.tex - emacs@esm.laptop' is open, showing LaTeX code for generating a table. The code includes a document class, a table environment, and a tabular environment with five columns. The table data is as follows:

hip	mag_abs_gaia	mag_abs_hip	b_v	
95905	2.90110612385656	3.08139684809066	0.394	
95838	3.36666243484313	3.60007543840966	0.707	
95662	4.21575480915181	4.96691320323364	0.683	
96089	3.67412200337596	3.99711049720092	0.609	
97946	3.95220466256254	3.93122863291356	0.495	
98189	4.08580555128650	3.90903495748743	0.639	

# TOPCAT & STILTS

- Concatenating tables in TOPCAT



- Only two tables at a time.

# TOPCAT & STILTS

- Concatenating multiple tables in STILTS

## B.24.2 Examples

Here are some examples of `tcat`:

```
stilts tcat ifmt=ascii in=t1.txt in=t2.txt in=t3.txt out=table.txt
```

Concatenates the three named ASCII format tables to produce an output table. All three must have compatible numbers and types of columns.

```
stilts tcat ifmt=ascii in="t1.txt t2.txt t3.txt" out=table.txt
```

Has exactly the same effect as the previous example.

```
stilts tcat ifmt=ascii in=@inlist.lis out=table.txt
```

This will have the same effect as the previous two examples if a file name "inlist.lis" in the current directory contains three lines, "t1.txt", "t2.txt" and "t3.txt".

- Same input format → `tcatn`
- Similar columns (in number and class).

# TOPCAT & STILTS

- Concatenating multiple tables in STILTS

```
stilts tcats nin=2 in1=survey.vot.gz ifmt2=csv in2=more_data.csv  
icmd1='addskycoords fk5 galactic RA2000 DEC2000 GLON GLAT' \  
icmd1='keepcols "OBJ_ID GLON GLAT"' \  
icmd2='keepcols "ident gal_long gal_lat"' \  
loccol=FILENAME  
omode=topcat
```

In this case we are trying to concatenate results from two tables which are quite dissimilar to each other. In the first place, one is a VOTable (no `ifmt1` parameter is required since VOTables can be detected automatically), and the other is a comma-separated-values file (for which the `ifmt2=csv` parameter must be given). In the second place, the column structure of the two tables may be quite different. By pre-processing the two tables using the `icmd1` & `icmd2` parameters, we produce in each case an input table which consists of three columns of compatible types and meanings: an integer identifier and floating point galactic longitude and latitude coordinates. The second table contains such columns to start with, but the first table requires an initial step to convert FK5 J2000.0 coordinates to galactic ones. `tcats` joins the two doctored tables together, to produce a table which contains only these three columns, with all the rows from both input tables, and sends the result directly to a new or running instance of TOPCAT. An additional column named FILENAME is appended to the table before sending it; this contains "survey.vot.gz" for all the columns from the first table and "more\_data.csv" for all the columns from the second one.

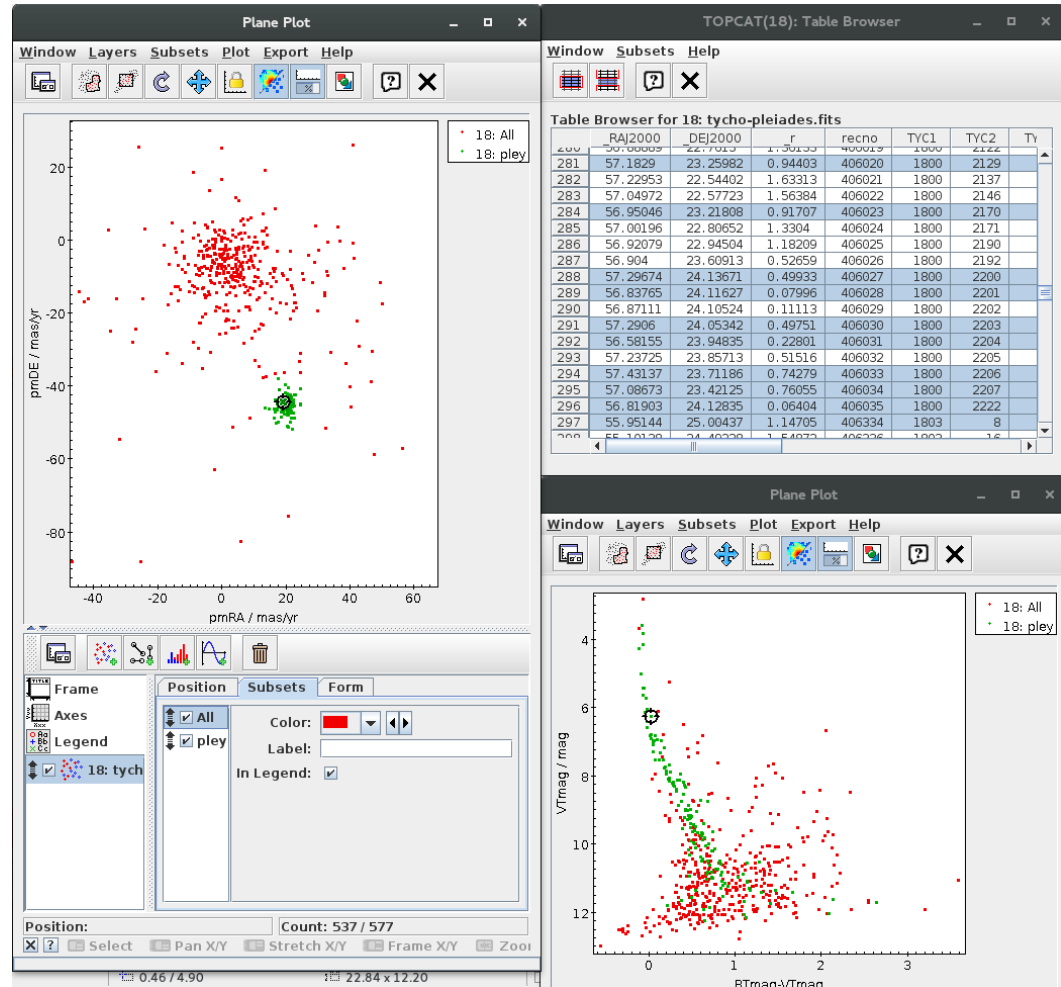
# TOPCAT & STILTS

- Functions in TOPCAT

The screenshot displays two windows from the TOPCAT software. The left window, titled 'Define Synthetic Column', contains a form with fields for Name, Expression, Units, Description, UCD (set to 'no UCD'), and Index (set to 47). A red circle highlights the 'f(x)' icon in the top-left corner of this window. The right window, titled 'Available Functions', shows a tree view of function categories. The 'Maths' category is expanded, and the function 'julianToMjd( julianEpoch )' is selected and highlighted. To the right of the function list, a detailed description is provided: 'Function julianToMjd( julianEpoch )', 'Description: Converts a Julian Epoch to Modified Julian Date...', 'Parameters: julianEpoch (floating point) Julian epoch', 'Return Value (floating point): modified Julian date', 'Example: julianToMjd(2000.0) = 51544.5', and 'Signature: double julianToMjd(double)'.

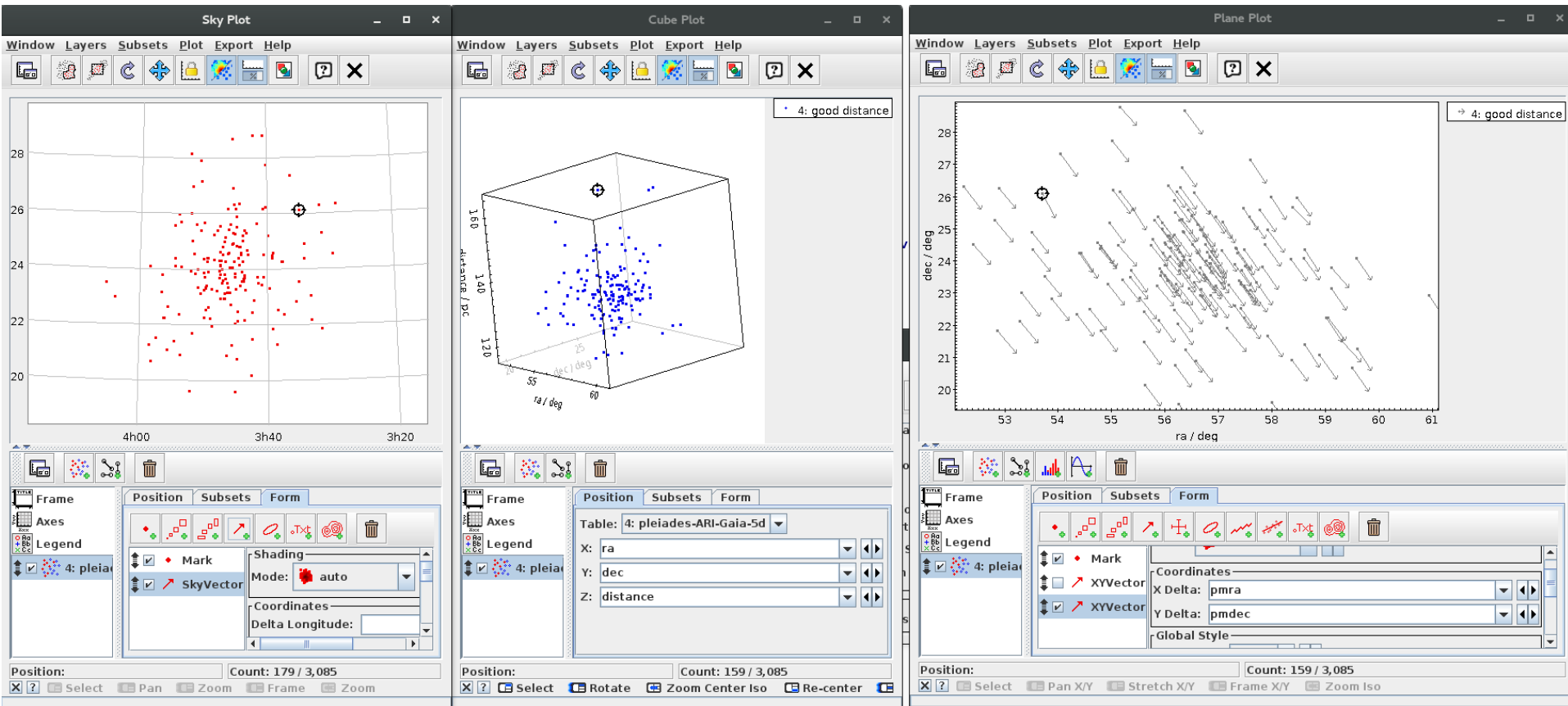
# TOPCAT & STILTS

- Linked views



# TOPCAT & STILTS

- Linked views





# TOPCAT & STILTS

- Crossmatching



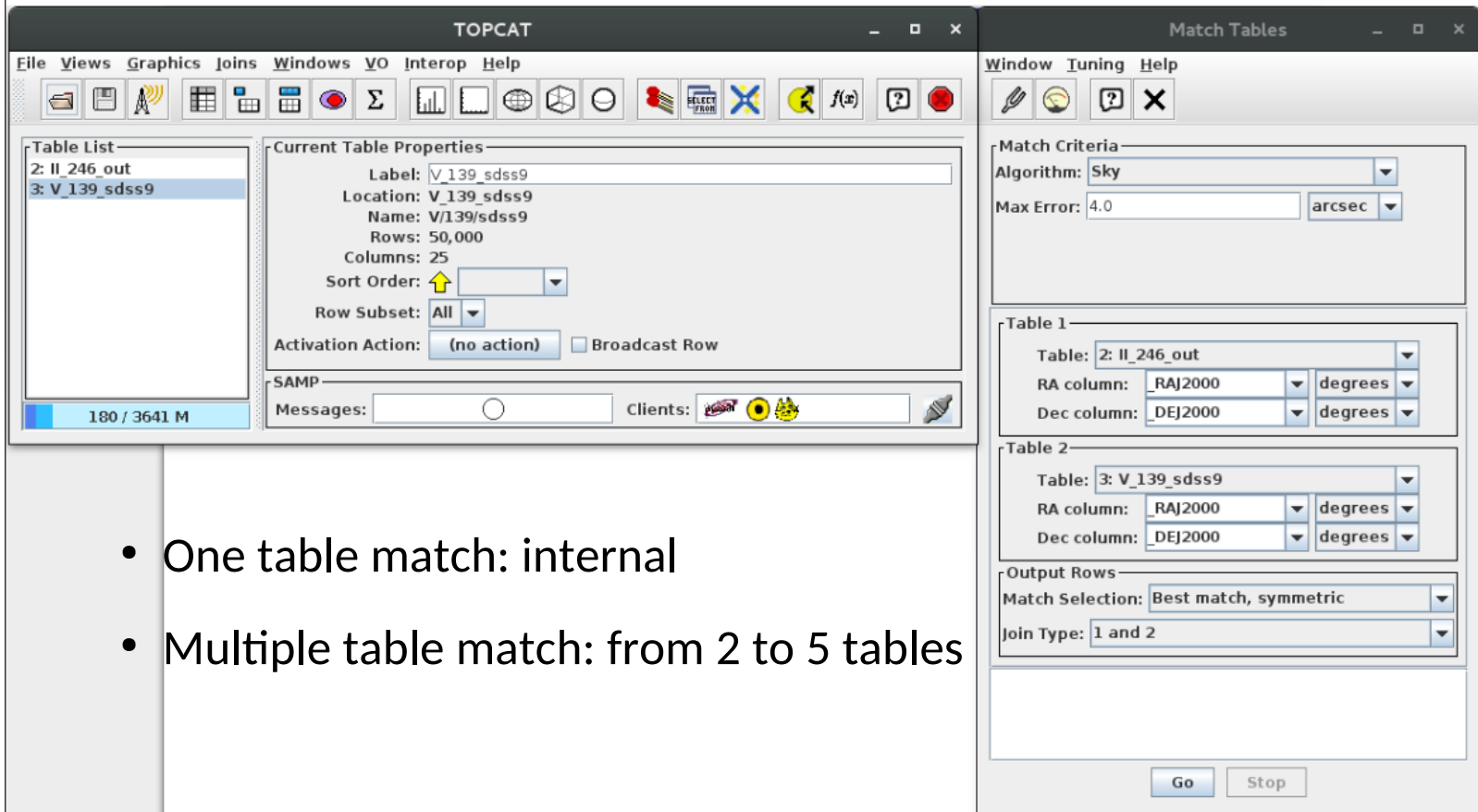
```
stilts tskymatch2 \  
  in1=tycho-pleiades.fits ra1=_RAJ2000 dec1=_DEJ2000 \  
  in2=2mass-pleiades.fits ra2=_RAJ2000 dec2=_DEJ2000 \  
  join=1and2 find=best error=1 \  
  out=tycho-2mass.fits \  
  \
```

- There are lots of different match types (Algorithm selector), not just Sky.
- Think about the output options. Especially in crowded fields, the default Best Match, Symmetric can give surprising results.
- For large tables (> million rows) , the crossmatch can run out of memory.
  - Tip: Increase heap memory (run with `java -jar -Xmx2048M topcat-full.jar`) or use the `java -disk` option.

# TOPCAT & STILTS

- **Crossmatching**  - How to x-match two **medium-size** catalogues?

TOPCAT → Joins / Pair match



The screenshot displays the TOPCAT software interface. The main window is titled 'TOPCAT' and features a menu bar (File, Views, Graphics, Joins, Windows, VO, Interop, Help) and a toolbar with various icons. On the left, a 'Table List' shows two tables: '2: II\_246\_out' and '3: V\_139\_sdss9'. The 'Current Table Properties' panel for 'V\_139\_sdss9' shows details like Label, Location, Name, Rows (50,000), Columns (25), Sort Order, Row Subset (All), and Activation Action. The 'Match Tables' window on the right is titled 'Match Tables' and contains configuration options for matching two tables. It includes a 'Match Criteria' section with 'Algorithm' set to 'Sky' and 'Max Error' set to 4.0 arcsec. Below, 'Table 1' is configured with 'Table: 2: II\_246\_out', 'RA column: RAJ2000', and 'Dec column: DEJ2000'. 'Table 2' is configured with 'Table: 3: V\_139\_sdss9', 'RA column: RAJ2000', and 'Dec column: DEJ2000'. The 'Output Rows' section shows 'Match Selection' set to 'Best match, symmetric' and 'Join Type' set to '1 and 2'. At the bottom of the 'Match Tables' window are 'Go' and 'Stop' buttons.

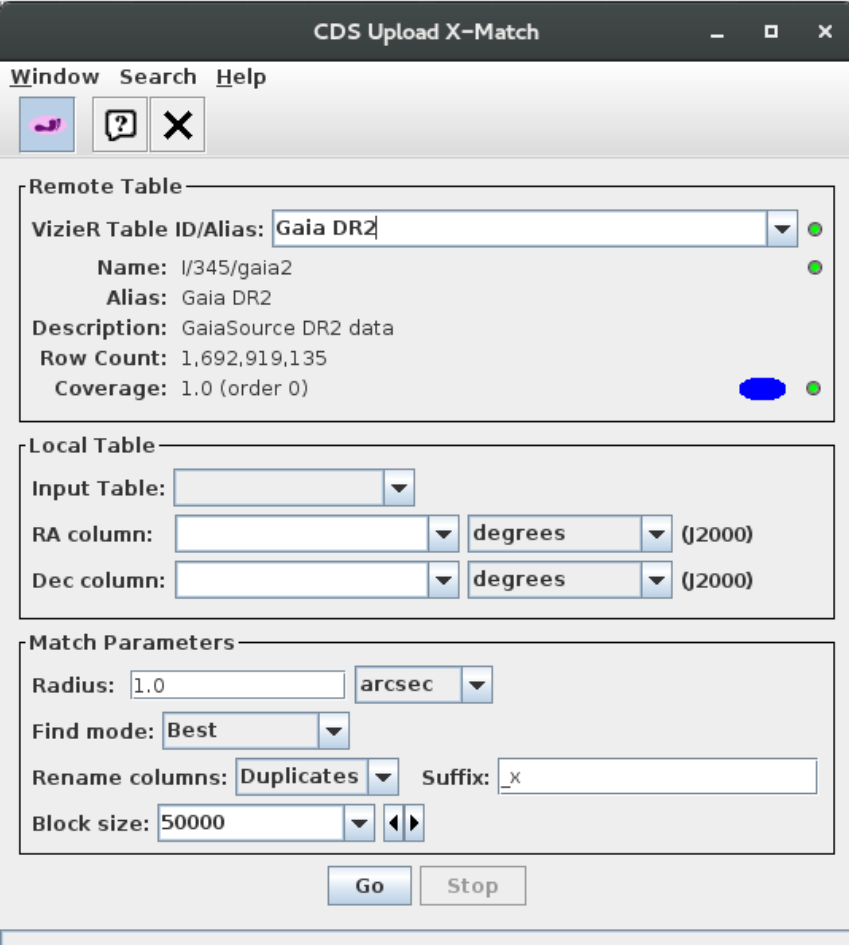
- One table match: internal
- Multiple table match: from 2 to 5 tables

# TOPCAT & STILTS

- **Crossmatching**  - How to x-match my catalogue with a **large catalogue** (in CDS) ?

TOPCAT → Joins → CDS Upload X-Match

- **Advantages:** Efficiency
- **Disadvantages:**
  - Only CDS catalogues
  - Only default columns



CDS Upload X-Match

Window Search Help

Remote Table

VizieR Table ID/Alias: Gaia DR2

Name: I/345/gaia2

Alias: Gaia DR2

Description: GaiaSource DR2 data

Row Count: 1,692,919,135

Coverage: 1.0 (order 0)

Local Table

Input Table:

RA column: degrees (12000)

Dec column: degrees (12000)

Match Parameters

Radius: 1.0 arcsec

Find mode: Best



Rename columns: Duplicates Suffix: \_x

Block size: 50000

Go Stop

# TOPCAT & STILTS

- **Crossmatching**  - How to x-match my catalogue with a **large catalogue** (in CDS) ?

Radmm  X Y  Hot Stuff for One Year (HSOY) (Altmann+, 2017) [2017A&A...600L...4A](#) [ReadMe+ftp](#)  
**I/339** [Post annotation](#) [Similar Catalogs](#)  
 1.I/339/hsoy The HSOY catalogue (583001653 sources) (original column names in green) (583001653 rows)

**Simple Constraint** **List Of Constraints**

Query by [Constraints](#) ? applied on Columns (Output Order:  +  - )  
 Standard  Original

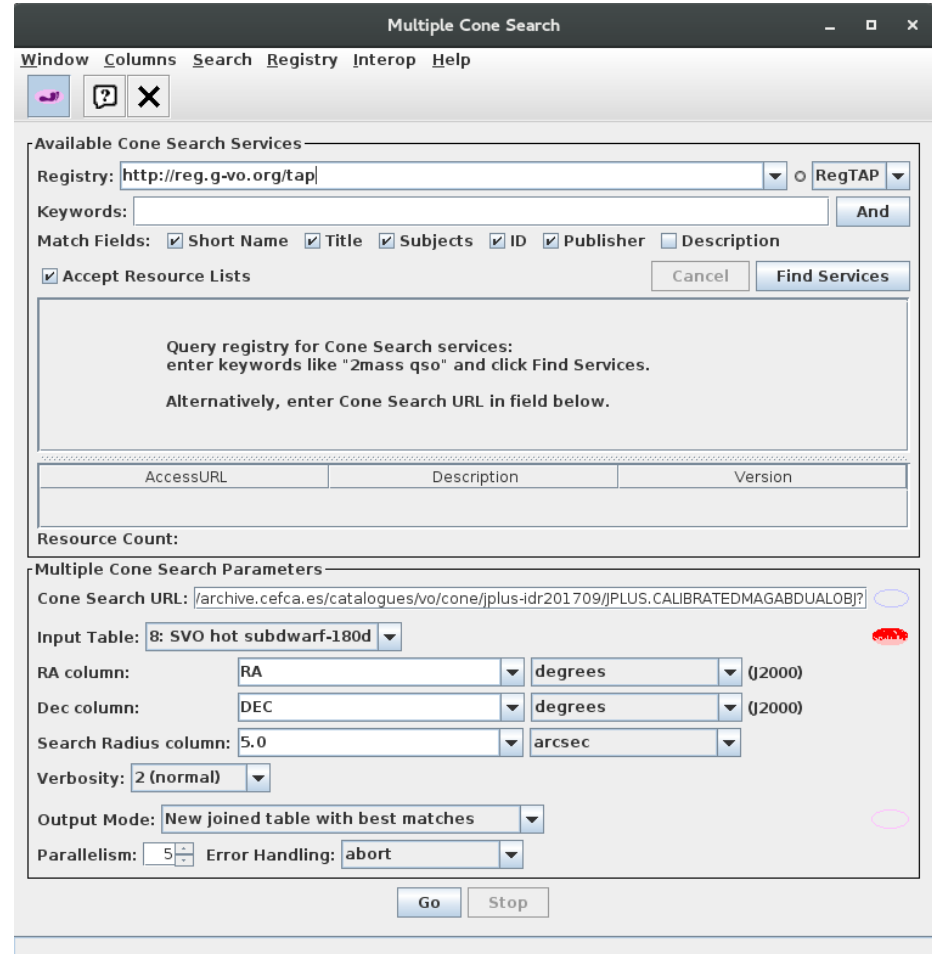
Show	Sort	Column	Clear	Constraint	Explain (UCD)
<input checked="" type="checkbox"/>	<input type="radio"/>	RAJ2000	<input type="text"/>	<a href="#">deg</a>	(i) Right ascension, J2000.0, at epoch 2000 ( <a href="#">raj2000</a> ) ( <a href="#">pos.eq.ra;meta.main</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	DEJ2000	<input type="text"/>	<a href="#">deg</a>	(i) Declination, J2000.0, at epoch 2000 ( <a href="#">dej2000</a> ) ( <a href="#">pos.eq.dec;meta.main</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	ipix	<input type="text"/>		(n)(i) PPMXL object identifier ( <a href="#">ipix</a> ) ( <a href="#">Note 1</a> ) ( <a href="#">meta.id;meta.main</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	comp	<input type="text"/>		[0/4] Disambiguation counter (where multiple DR1 objects match one PPMXL object) ( <a href="#">comp</a> ) ( <a href="#">Note 1</a> ) ( <a href="#">meta.code.multip</a> )
<input type="checkbox"/>	<input type="radio"/>	e_RAJ2000	<input type="text"/>	<a href="#">mas</a>	Mean error: RA*cos(DE) at mean epoch EpRA ( <a href="#">e_ra</a> ) ( <a href="#">stat.error;pos.eq.ra</a> )
<input type="checkbox"/>	<input type="radio"/>	e_DEJ2000	<input type="text"/>	<a href="#">mas</a>	Mean error: DE at mean epoch EpDE ( <a href="#">e_de</a> ) ( <a href="#">stat.error;pos.eq.dec</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	pmRA	<input type="text"/>	<a href="#">mas/yr</a>	Proper motion in RA, pmRA*cos(DE) ( <a href="#">pmra</a> ) ( <a href="#">pos.pm;pos.eq.ra</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	pmDE	<input type="text"/>	<a href="#">mas/yr</a>	Proper motion in DE ( <a href="#">pmde</a> ) ( <a href="#">pos.pm;pos.eq.dec</a> )
<input type="checkbox"/>	<input type="radio"/>	e_pmRA	<input type="text"/>	<a href="#">mas/yr</a>	Mean error in pmRA ( <a href="#">e_pmra</a> ) ( <a href="#">stat.error;pos.pm;pos.eq.ra</a> )
<input type="checkbox"/>	<input type="radio"/>	e_pmDE	<input type="text"/>	<a href="#">mas/yr</a>	Mean error in pmDE ( <a href="#">e_pmde</a> ) ( <a href="#">stat.error;pos.pm;pos.eq.dec</a> )

# TOPCAT & STILTS

- Crossmatching  - How to x-match my catalogue with a **large catalogue** (in CDS) ?

TOPCAT → VO → Multicone

- Disadvantages:
  - slow



The screenshot shows the 'Multiple Cone Search' window. It has a menu bar with 'Window', 'Columns', 'Search', 'Registry', 'Interop', and 'Help'. Below the menu bar are icons for home, help, and close. The main area is divided into several sections:

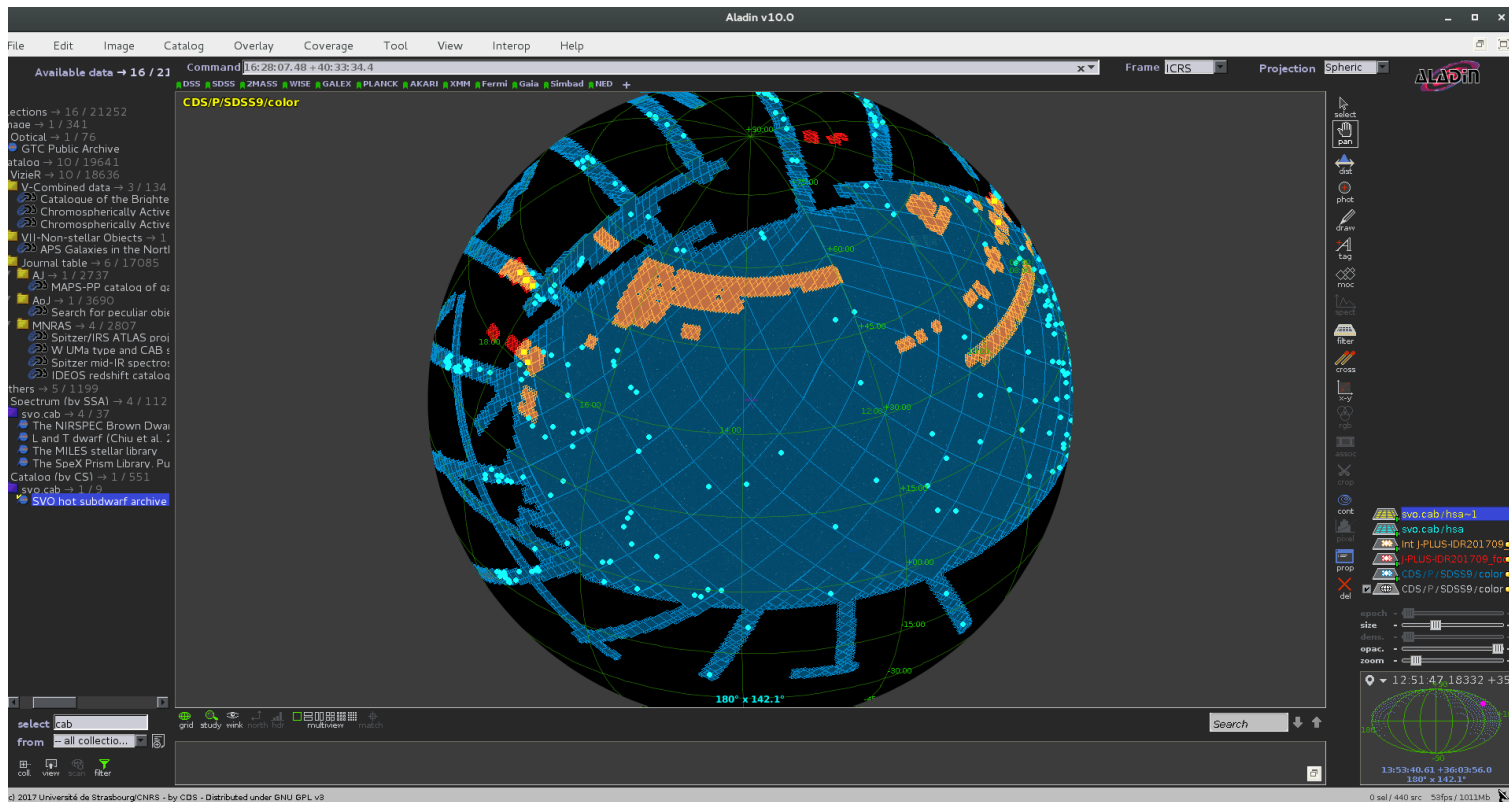
- Available Cone Search Services:** Registry:  RegTAP. Keywords:  And. Match Fields:  Short Name  Title  Subjects  ID  Publisher  Description.  Accept Resource Lists. Buttons: Cancel, Find Services.
- Query registry for Cone Search services:** enter keywords like "2mass qso" and click Find Services. Alternatively, enter Cone Search URL in field below.
- Table:** Headers: AccessURL, Description, Version.
- Resource Count:**
- Multiple Cone Search Parameters:** Cone Search URL:  Input Table: 8: SVO hot subdwarf-180d. RA column: RA degrees (J2000). Dec column: DEC degrees (J2000). Search Radius column: 5.0 arcsec. Verbosity: 2 (normal). Output Mode: New joined table with best matches. Parallelism: 5. Error Handling: abort. Buttons: Go, Stop.

# TOPCAT & STILTS

- **Crossmatching**  - How to x-match my catalogue with a **large catalogue** (in CDS) ?

Alternative (for non all-sky surveys)

- Filter a table by MOC → X-match the filtered table



The screenshot shows the Aladin v10.0 software interface. The main window displays a 3D visualization of a star field with a grid overlay. The interface includes a menu bar (File, Edit, Image, Catalog, Overlay, Coverage, Tool, View, Interop, Help), a command line (Command: 16:28:07.48 +40:33:34.4), and a list of available data sources on the left. The main window displays a spherical view of the sky with a grid and various colored points representing stars. The bottom status bar shows coordinates (12 51 47.18332 +35) and zoom level (13953+40.01 +36:03:56.0).

# TOPCAT & STILTS

- Crossmatching  - How to x-match two large catalogues (in CDS) ?

- Disadvantages:
  - No filtering
  - Large outputs



CDS X-Match Service

Choose tables to cross-match

Gaia DR2 PanSTARRS DR1

VizieR SIMBAD My store VizieR SIMBAD My store

Gaia DR2 (Gaia Collaboration, 2018)  
1,692,919,135 rows

The Pan-STARRS release 1 (PS1) Survey - DR1 (Chambers+, 2016)  
1,919,106,885 rows

Show options

Begin the X-Match

Visualize and manage your cross-match jobs

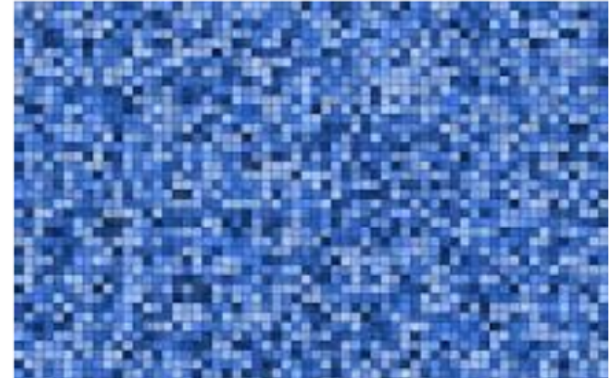
Table 1	Table 2	Options	Begin	Status	Actions
No job in list					

For the selected job(s): Delete

# TOPCAT & STILTS

- Crossmatching  • - How to x-match two large catalogues (in CDS) ?  
(Alternative)

- STILTS



- Cross-match

```
java -jar stilts.jar tskymatch2 ifmt1=votable in1=2mass.xml ifmt2=votable  
in2=sdss.xml ra1="RAJ2000" dec1="DEJ2000" ra2="RAJ2000" dec2="DEJ2000"  
error=10 find=all out=cross.xml ofmt=votable'
```

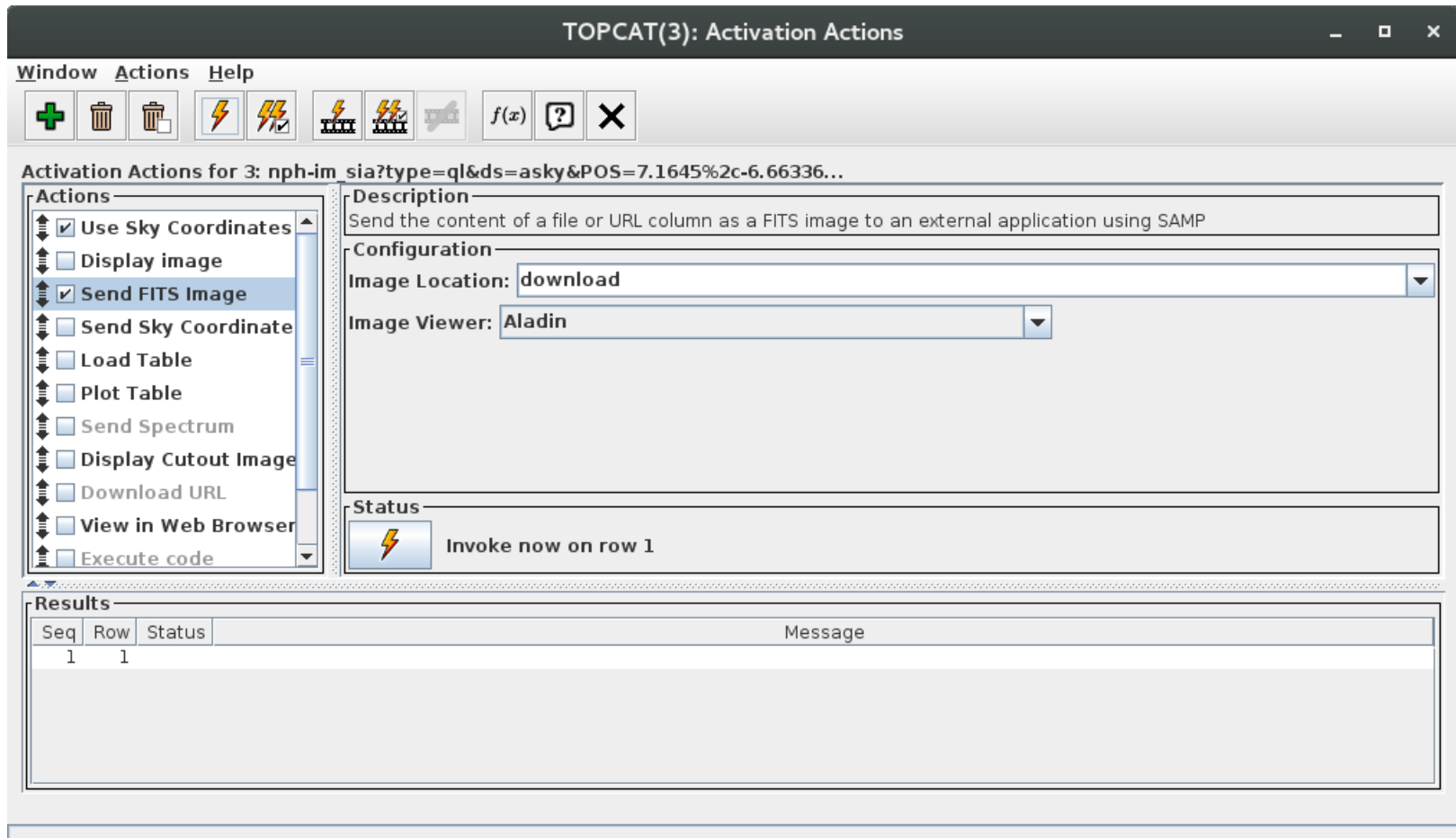
- Filtering

```
java -jar stilts.jar tpipe ifmt=votable in=cross.xml cmd="select  
zmag>12&&zmag<19.5&&rmag-kmag>(zmag+0.5)/2.5&&(rmag-  
kmag)<(zmag+10.5)/2.5&&e_Kmag>0" out=rmkz.xml ofmt=votable
```



# TOPCAT & STILTS

- Activation actions and activation window



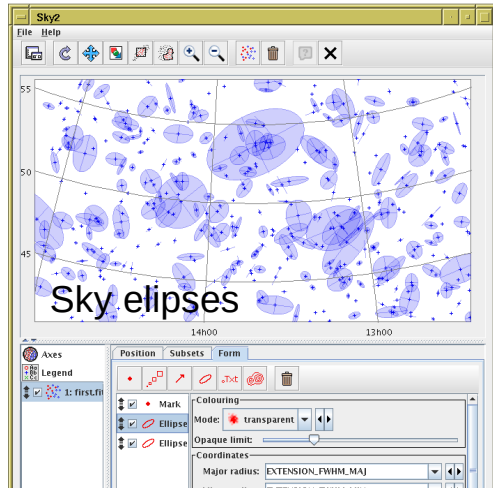
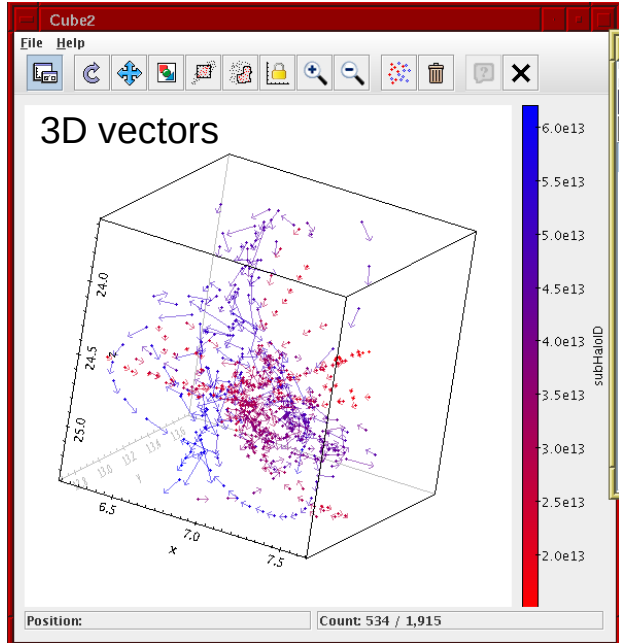
# TOPCAT & STILTS

- Activation actions and activation window

The image displays two software windows. The top-left window is 'Starlink SPLAT-VO: A Spectral Analysis Tool'. It shows a 'Global list of spectra' with a selected file, and 'Properties of current spectra' including short and full names, format (TABLE), and column settings (WAVELENGTH, FLUX, SIGMA). The bottom-left window is 'Starlink SPLAT-VO: <plotO>'. It shows a plot of 'Data count (erg/cm<sup>2</sup>/s/Å)' versus 'Wavelength (Angstrom)'. The plot shows a noisy spectrum with a peak around 2000 Å. The right side of the image shows the 'TOPCAT' interface. The 'Table List' shows two tables: '29: ll\_246\_out' and '31: ssas(29)'. The 'Current Table Properties' for '31: ssas(29)' shows 34 rows and 50 columns. The 'Activation Action' is set to 'spectrum(Spectrum)'. The 'Table Browser for 31: ssas(29)' shows a table with columns for AXES, UNITS, and DIMEQ. The table contains 18 rows of data.

	AXES	UNITS	DIMEQ
1	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
2	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
3	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
4	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
5	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
6	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
7	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
8	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
9	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
10	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
11	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
12	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
13	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
14	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
15	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
16	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
17	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3
18	WAVELENGTH FLUX SIGMA QUALITY	ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a	L ML-1T-3 ML-1T-3

# TOPCAT: Visualization



TOPCAT

Table List

Current Table Properties

Density Map

Scatter Plot

Spherical Plot

Cone Selection

Match Tables

Line Plot

A.3 Table View

Histogram

Table Columns

Row Subsets

Axis Configuration

# TOPCAT & STILTS

- More at:

- TOPCAT v 4.7

<http://www.star.bris.ac.uk/~mbt/topcat/sun253/sun253.html>

- STILTS v 3.2

<http://www.star.bris.ac.uk/~mbt/stilts/sun256/sun256.html>

- TOPCAT/STILTS advanced tutorial

<http://andromeda.star.bris.ac.uk/topcat/tutorial-asterics1/>